# CLAIMS

We claim:

1. A system for the inspection of a precious stone, comprising:

an energy transfer system for changing the temperature of said stone;

at least one imaging device imaging said stone and outputting a thermal map of said stone;

an image processing unit utilizing said thermal map to determine regions having changed emission in said thermal map; and

an analyzing unit detecting at least one imperfection in said stone from said regions of changed emission.

2. A system according to claim 1 and wherein said detecting comprises determining at least one of the location, character and size of said at least one imperfection.

3. A system according to claim 1 and wherein said energy transfer system comprises an energy source such that said changing the temperature of said stone comprises raising the temperature of said stone above that of its environment.

4. A system according to claim 1 and wherein said energy transfer system comprises an energy sink such that said changing the temperature of said stone comprises lowering the temperature of said stone below that of its environment.

5. A system according to claim 1 and wherein said at least one imaging device images said stone in the infra red region.

6. A system according to claim 1 and wherein said at least one imaging device is a camera.

7. A system according to claim 1 and wherein said regions of changed emission result from a change in temperature at said location from the temperature in the remainder of said stone.

8. A system according to claim 1 and wherein the characteristics of said at least one imperfection in said stone is determined from the level of said changed emission.

9. A system according to claim 7 and wherein the characteristics of said at least one imperfection in said stone is determined from the level of said changed temperature.

10. A system according to claim 1, and wherein said at least one imaging device is two imaging devices, such that said location of said at least one imperfection in said stone is determined in three dimensions.

11. A system according to claim 1, and wherein said stone is angularly aligned relative to said imaging device for imaging in at least two directions, such that said location of said at least one imperfection in said stone is determined in three dimensions.

12. A system according to claim 11, and wherein said stone is angularly realigned relative to said imaging device by means of a turntable on which said stone is mounted.

13. A system according to claim 3, and wherein said energy source for raising the temperature of said stone is at least one of a radiation source, a hot air source, and a conduction source.

14. A system according to claim 13 and wherein said radiation source emits at least one of infra red, visible or ultra violet energy.

15. A system according to claim 13 and wherein said conduction source is a hot plate.

16. A system according to claim 14 and also comprising a filter disposed between said source and said stone, such that said stone is irradiated with energy having a more limited wavelength bandwidth than the imaging bandwidth.

17. A system according to claim 14 and also comprising a filter disposed between said stone and said imaging device, such that said stone is imaged at a wavelength bandwidth more limited than that of said radiation.

18. A system according to claim 16 and wherein said filter is operative to reduce the effect of reflections or scattering of said energy from said radiation source on said images of said stone.

19. A system according to claim 17 and wherein said filter is operative to reduce the effect of reflections or scattering of said energy from said radiation source on said images of said stone.

20. A system according to claim 4, and wherein said energy sink for lowering the temperature of said stone is a thermo-electric cooling device.

21. A system according to claim 1 and also comprising at least a pair of polarizing elements, at least one element being located between said energy source and said stone, and at least another element being located between said stone and said imaging device.

22. A system according to claim 1 and wherein said stone is a diamond.

23. A system according to claim 1 and wherein said imperfection is an inclusion.

24. A system according to claim 1 and wherein said imperfection is an internal structural flaw.

25. A system according to claim 1 and wherein said imaging device generates successive images of said stone at different temperatures and at a fixed wavelength, and determines the characteristics of a detected imperfection by comparison with predetermined information relating to the emissive properties of imperfections as a function of temperature.

26. A system according to claim 1 and wherein said imaging device generates successive images of said stone at different wavelengths and at a fixed temperature, and determines the characteristics of a detected imperfection by comparison with predetermined information relating to the emissive properties of imperfections as a function of wavelength.

27. A method for the inspection of a precious stone, comprising the steps of:

changing the temperature of said stone by means of an energy transfer system;

imaging said stone by means of at least one imaging device;

outputting a thermal map of said stone from said at least one imaging device;

image processing said thermal map to determine regions of changed emission in said thermal map; and

analyzing said regions of changed emission for detecting at least one imperfection in said stone.

28. A method according to claim 27 and wherein said detecting comprises determining at least one of the location, character and size of said at least one imperfection.

29. The method of claim 27 and wherein said energy transfer system comprises an energy source such that said step of changing the temperature of said stone comprises the step of raising the temperature of said stone above that of its environment.

30. The method of claim 27 and wherein said energy transfer system comprises an energy sink such that said step of changing the temperature of said stone comprises the step of lowering the temperature of said stone below that of its environment.

31. The method of claim 27 and wherein said at least one imaging device images said stone in the infra red region.

32. The method of claim 27 and wherein said at least one imaging device is a camera.

33. The method of claim 27 and wherein said regions of changed emission result from a change in temperature at said location from the temperature in the remainder of said stone.

34. The method of claim 29 and wherein said imaging step is performed after terminating said step of raising the temperature of said stone above that of its environment by means of said energy source.

35. The method of claim 34 and wherein said step of terminating said raising the temperature of said stone is performed by means of a shutter.

36. The method of claim 34 and wherein said energy transfer to said stone is by means of at least one pulse of energy.

37. The method of claim 27 and wherein said imaging step is performed while said step of changing the temperature of said stone by means of an energy transfer system is continued.

38. The method of claim 27, and wherein said step of imaging said stone by means of at least one imaging device is performed by means of two imaging devices, such that said location of said at least one imperfection in said stone is determined in three dimensions.

39. The method of claim 27, and also comprising the step of angularly aligning said stone relative to said imaging device in at least two directions for performing said imaging, such that said location of said at least one imperfection in said stone is determined in three dimensions.

40. The method of claim 39, and wherein said step of angularly aligning said stone comprises the steps of:

providing a turntable for mounting said stone thereupon; and

rotating said turntable with said stone mounted thereon to image said stone in at least two directions, such that said location of said at least one imperfection in said stone is determined in three dimensions.

41. The method of claim 29, and wherein said energy source is at least one of a radiation source, a hot air source, and a conduction source.

42. The method of claim 41, and wherein said conduction source is a hot plate.

43. The method of claim 41, and wherein said radiation source emits at least one of infra red, visible or ultra violet energy.

44. The method of claim 43, and also comprising the step of disposing a filter between said radiation source and said stone, such that said stone is irradiated with energy having a more limited wavelength bandwidth than the imaging bandwidth.

45. The method of claim 43, and also comprising the step of disposing a filter between said stone and said imaging device, such that said stone is imaged at a wavelength bandwidth more limited than that of said radiation.

46. The method of claim 44, and wherein said filter is operative to reduce the effect of reflections or scattering of said energy from said radiation source on said images of said stone.

47. The method of claim 30, and wherein said energy sink for the step of lowering the temperature of said stone below that of its environment is a thermo-electric cooling device.

48. The method according to claim 27 and wherein said stone is a diamond.

49. The method according to claim 27 and wherein said imperfection is an inclusion.

50. The method according to claim 27 and wherein said imperfection is an internal structural flaw.

51. A computerized optical system for the analysis of precious stones, comprising a stone mapping module inputting information to an output shape allocator, said stone mapping module taking its inputs from:

a three dimensional spatial model of said stone;

an input module defining a desired shape of at least one cut to be obtained from said precious stone; and

output information from a computerized imperfection detection unit.

52. A computerized optical system for the analysis of precious stones, according to claim 51, wherein said three dimensional spatial model of said stone comprises at least one of:

a set of co-ordinates defining the envelope of said stone;

a set of three-dimensional polygonic shapes; and

a set of shapes defining planes in said stone, and their vectorial directions relative to a known origin.

53. A computerized optical system for the analysis of precious stones, according to claim 51, wherein said three dimensional spatial model of said stone is obtained from at least one of:

a stone dimension measuring unit;

a stone shape measuring unit;

a hole data input unit; and

groove data input unit.

54. A computerized optical system for the analysis of precious stones, according to claim 51, and wherein said computerized imperfection detection unit also provides outline data of said stone for said three dimensional spatial model of said stone.

55. A computerized optical system for the analysis of precious stones, according to claim 51, and wherein said computerized imperfection detection unit is a thermal imaging imperfection detection system.